SOURCE CONTROL EVALUATION REPORT

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OREGON DEQ ECSI FILE NO. 2426

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1.0 INTRODUCTION

1.1 PURPOSE

This Source Control Evaluation (SCE) Report has been prepared by Pacific Crest Environmental, LLC (Pacific Crest) on behalf of the Christenson Oil Company (Christenson Oil) to present the results of a stormwater SCE at the Christenson Oil Facility (Facility) located at 3821 N.W. St. Helens Road in Portland, Oregon (the Site). A Site Location Map and Detailed Site Plan are provided as Figure 1 and Figure 2, respectively.

This SCE was conducted in response to the Oregon Department of Environmental Quality (DEQ) correspondence dated January 22, 2010 requesting that Christenson Oil perform a stormwater SCE to identify, evaluate, and control sources of contamination that have the potential to impact the Willamette River in a manner consistent with the DEQ's *Guidance for Evaluating the Stormwater Pathway at Upland Sites* (DEQ, 2009).

1.2 SOURCE CONTROL OBJECTIVE

The objective of this stormwater SCE Report is to demonstrate that existing and potential sources of contamination at the Site have been addressed and that no additional characterization or source control measures are needed at the Site.

1.3 REGULATORY FRAMEWORK

The DEQ has designated the Facility as an Upland Site in the Remedial Investigation/Feasibility Study (RI/FS) for the Portland Harbor Superfund Site. The DEQ and US Environmental Protection Agency (EPA) have developed the Portland Harbor Joint Source Control Strategy (JSCS) to identify, evaluate, and control sources of contamination that may reach the Willamette River. As such, it is necessary for Upland Sites in Portland Harbor to evaluate the stormwater pathway to identify upland sources of contamination that adversely impact, or have the potential to adversely impact, the Willamette River, and to implement appropriate source control measures (SCMs) to the extent practical prior to sediment cleanup in the Portland Harbor Superfund Site.

In addition to its designation as an Upland Site for the Portland Harbor Superfund Site RI/FS, recent and historical environmental investigation and monitoring activities have been conducted to assess conditions associated with historical releases of petroleum hydrocarbons at the Site. Groundwater monitoring and remedial activities have and continue to be conducted under the guidance of the DEQ Voluntary Cleanup Program (VCP).

Stormwater data collected for the Facility's National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge General Permit 1200-Z (NPDES General Permit) was integrated, to the extent applicable, with the stormwater SCE. Stormwater samples collected for the NPDES General Permit prior to the implementation of SCMs at the Site provide evidence of SCM effectiveness and are, therefore, provided as Table 1.

1.4 REPORT ORGANIZATION

The Report will be organized as follows:

Section 1.0 Introduction – Presents an introduction, a statement of objectives, project organization and responsibilities, and report organization.

Section 2.0 – Site Description and History – Presents a Site description, a summary of current and historical Site activities, and a description of the Site's stormwater conveyance system.

Section 3.0 – Potential Sources and Contaminants of Interest – Provides information regarding potential contaminant sources, outfall sediment data, and contaminants of interest (COIs).

Section 4.0 – Ongoing Stormwater Management Measures – Presents a summary of ongoing stormwater Best Management Practices (BMPs) conducted at the Site, and information on the mechanisms in place to document the ongoing activities.

Section 5.0 – Data Collection and Interpretation – Presents Site specific sampling procedures, a summary of data collected, and interpretation of those data.

Section 6.0 – Source Control Measures – Presents a detailed description of any source control evaluation measures used at the Site during the course of this evaluation.

Section 7.0 – Source Control Evaluation – Presents evidence to support the determination that stormwater source control has been accomplished, and no additional source control measures are required at the Site.

Section 8.0 – Findings and Conclusions – Presents findings and conclusions regarding the Site specific SCE.

Section 9.0 – References – Presents a bibliography identifying reports and documents referenced in this Report.

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION

The Site is located within Section 19, Township 1 North, Range 1 East of the Willamette Meridian, in the City of Portland, Multnomah County, Oregon (Figure 1), and is situated between the wooded Tualatin Mountains to the west, and the Willamette River to the northeast. The surface elevation of the Site is between approximately 40 to 80 feet above mean sea level (amsl), with an overall surface topographic slope towards the Willamette River located approximately 0.5-mile to the northeast. The southwestern third of the Site slopes steeply toward the northeast, followed by a slope break to a gentle northeasterly slope over the remainder of the Site. The Site surface cover is a mixture of impervious asphalt, concrete, and structures on the northeast portion of the Site, and pervious soil on the southwest portion. Utilities at the Site include City of Portland (COP) storm sewer, water, sanitary sewer, and Northwest Natural Gas line as illustrated in Figure 2.

Shallow groundwater underlying the Site is encountered at approximately 4 to 6 feet below ground surface (bgs) in the eastern portion of the Site and greater than 20 feet bgs in the western portion of the Site. The overall direction of shallow groundwater flow beneath the Site is to the northeast, with minor localized variations attributed to surface topography, and variable permeabilities between surface cover and shallow subgrade materials. A map with the potentiometric surface of the Site is provided as Figure 3.

The Site is developed with two structures, including an approximately 19,000 square-foot, single-level building (Main Building) and an approximately 2,000 square-foot storage building (Storage Building). According to the COP, the Main Building was constructed in 1947. The Main Building is a prefabricated Quonset-style metal building made of galvanized steel. The Main Building includes an office and warehouse space, an assembly line for packaging product, and three indoor aboveground storage tank (ASTs) areas (Tank Farms C, D and E) for storing and blending petroleum-based lubricants. There are currently thirty-three indoor ASTs with an aggregate storage capacity of approximately 122,700 gallons. Paved loading and receiving docks are located at the front of the Main Building and slope towards a catch basin located in the receiving area (CB-1). Behind the Main Building, additional ASTs are segregating into two areas (Tank Farms A and B), each of which are fully enclosed by secondary containment. Tank Farms A and B include thirteen additional ASTs with a total storage capacity of approximately 183,900 gallons. Site features are presented on Figure 2.

The Site is located within an area of northwest Portland zoned as “heavy industrial”. The Site is bordered to the west by Forest Park; to the south-southeast by Baxter-Flaming Industries, which has reportedly operated as a varnish factory, a putty factory, and wrecking facility; to the east-northeast by NW St. Helens Road and beyond by a bulk terminal owned by Shell Oil Products Company (DEQ ECSI No.169); and to the north-northwest by an approximately 3-acre property leased by Christenson Oil from HAJ Properties, LLC for administrative and warehousing functions other than manufacturing.

2.2 STORMWATER CONVEYANCE SYSTEM

The Site consists of a single stormwater basin (Basin A) conveying stormwater either into the COP stormwater system in areas with impervious surfaces (e.g. metal roof and pavement) or into the subsurface in areas with pervious surfaces. The overland flow of stormwater at the Site is generally from the southwest to northeast, in the general direction of the topographic slope (Figure 4). The stormwater flow collected from impervious areas of Basin A is collected in catch basin CB-1, located in the paved parking area southeast of the Main Building. Stormwater is conveyed from catch basin CB-1 through underground piping into a 6,300-gallon capacity oil water separator (OWS) and, after passing through the OWS, travels through underground piping into the COP shared stormwater conveyance system located in the right-of-way of NW St. Helens Road. Heritage Surveying of Portland, Oregon (Heritage) conducted a survey of the components of the Site stormwater system and other relevant features relative to a COP benchmark (BM 3319). The survey indicated that the invert elevation of the shallow flow components of the stormwater system conduits (i.e., catch basin, culverts, inflow and outflow to the oil/water separator) are located at a relatively higher elevation, and do not intersect the groundwater table. A copy of the map generated by Heritage is provided in Appendix A.

The COP stormwater conveyance system extends east beneath the Shell Bulk Terminal and stormwater collected in this system ultimately discharges into the Willamette River at Outfall #18, near River Mile 8.8.

The exceptions to the general stormwater flow at the Site are summarized as follows:

- Precipitation and stormwater runoff in the western unpaved portion of the Site, west of the Main Building, is expected to infiltrate directly into the subsurface.
- Overland flow of stormwater from Forest Park is diverted into Green Creek, an intermittent stream, located parallel to the north-northwest property boundary. Prior to the mid-1980s, Green Creek flowed beneath the Facility. In the mid-1980s, the COP rerouted Green Creek to its present location parallel to the north-northwest Site boundary (Figure 2). Green Creek flows through a 36-inch diameter culvert from the northwest Site property corner and daylights approximately 120 feet west of NW St. Helens Road. Flow from Green Creek enters the stormwater system through a 12-inch pipe located approximately 10 feet west of NW St. Helens Road (Figure 2).
- Stormwater flow from NW St. Helens Road is captured in catch basins CB-2 and CB-3, located in the right-of-way of NW St. Helens Road (Figure 4). Catch basin CB-3 is located in the NW St. Helens Road right-of-way, adjacent to the northern corner of the Site near the confluence of Green Creek with the COP conveyance system. Catch basin CB-2, located in the NW St. Helens Road right-of-way, is adjacent to the eastern corner of the Site. Stormwater flow received from catch basins CB-1, CB-2, and CB-3 converge in the COP stormwater conveyance system which extends east beneath the Shell/Equilon Bulk Terminal and ultimately discharges at Outfall #18 near River Mile 8.8.

2.2.1 Stormwater Conveyance System Survey

On February 4, 2013, a stormwater conveyance system survey was conducted by River City Environmental, Inc. of Portland, Oregon (River City) using an inline video camera to observe the condition of storm sewer conduits and subsurface components servicing the Site. River City was subcontracted and directed by Wohlers Environmental Services, Inc. (Wohlers) of Tigard, Oregon. As determined by the diameter of the sewer pipe, either a maneuverable, remote-controlled video camera or a push camera equipped with fiber rods was used during the survey to record the location of the camera in the system and the corresponding condition of the storm sewer. Wohlers field personnel attempted to survey the following sections of the stormwater system:

- The stormwater system located between CB-1/OWS in the loading area of the Site and the shared COP conveyance system in the adjacent right-of-way; and
- The stormwater system located between the Green Creek inlet and the confluence with the conveyance piping from CB-1/OWS.

The actual stormwater conveyance system survey videos are provided as Appendix B. Notable observations are listed below.

- Access to the sewer connecting the OWS to the catch basin was gained via a stormwater service vault in the NW St. Helens Road right-of-way. This section of sewer extends approximately 14 feet northwest of the service vault before turning sharply to the southwest toward the OWS. It appears that a “T” joint was used by the City of Portland during construction of the sewer rather than a 90 degree “elbow” joint; therefore, the northwestern opening of the “T” joint was intentionally blocked using cobbles, small boulders and cement to seal the unnecessary opening.
- Wohlers field personnel were unable to survey the northwest to southeast trending sewer section connecting City Manhole AAT511 to Manhole AAT510 located in the NW St. Helens Road right-of-way due to camera inaccessibility. Survey contractors reported that approximately fifty percent of the 12” concrete pipe was congested with gravel and cobbles, despite repeated attempts to clear the line using a Vactor® truck jetter.

An illustration of the sections of sewer that were successfully surveyed is provided as Figure 5. With the exception of the issues discussed above, no other notable observations were made during the stormwater conveyance system survey.

2.3 SITE OWNERSHIP AND OPERATING HISTORY

The Site has been operated by Christenson Oil and predecessor businesses since the late 1940s. Christenson Oil has conducted mixing, blending, packaging, and storage of various petroleum-based lubrication products in five tank farms located on Site (Figure 2), and in former underground storage tanks (USTs) which contained diesel, kerosene, and Stoddard Solvent. The former USTs were decommissioned between 1989 and 1993.

There have been several documented releases of petroleum products from ASTs and USTs on the property since 1975. The products reportedly released at the Site have included: base oil (Bright Stock), diesel fuel, kerosene, Stoddard Solvent (a type of mineral spirits), hydraulic oil, and chain oil. Following each release, mitigation measures were conducted to control the release; recover the lost product; and to clean up impacted media. Additional information regarding historical releases at the Site is provided in the *Expanded Preliminary Assessment Report* (XPA) prepared by Wohlers, dated December 4, 2006 (Wohlers, 2006A).

2.4 REGULATORY HISTORY

This section presents an overview of the regulatory history of the Site in relation to stormwater discharge, regulated tanks, and hazardous waste generation.

2.4.1 Stormwater Permit

Stormwater discharge from the Site is permitted under Christenson Oil’s NPDES General Permit. The NPDES General Permit was initially obtained in 1998, with subsequent renewals as necessary. The NPDES General Permit specifies the requirements, limitations, and operating conditions for the management of stormwater at the Site, including implementation of an approved *Stormwater Pollution Control Plan* (SWPCP); regular stormwater and sediment monitoring; inspections and reporting; and guidance for SCMs. Prior to April 2008, the stormwater monitoring requirements under the permit consisted of the collection of a minimum of four grab stormwater samples per year and analysis of Total Suspended Solids (TSS), Oil & Grease (O&G), pH, copper, lead, and zinc, with monthly inspections consisting of visual assessments of floating solids and O&G sheen at representative discharge locations.

In April 2008, on the basis of an exemplary compliance record, Christenson Oil obtained a "Monitoring Waiver" (Waiver) from the COP Bureau of Environmental Services (BES) for all analytes except for pH. Christianson Oil subsequently obtained a Waiver for the analysis of pH in November 2008. The Waiver applied to the collection of stormwater samples at the outlet of the OWS. While the Waiver was in effect, the stormwater monitoring requirements consisted of monthly visual monitoring for the presence of O&G sheen and floating solids.

Stormwater discharge sampling resumed upon the DEQ issuance of a revised NPDES General 1200-Z Industrial Discharge Permit on July 1, 2012. The revised permit contains requirements for the analysis of additional analytes, as well as the frequency and timing of sample collection. A summary of the stormwater discharge sampling data conducted at the Site is provided in Table 1.

2.4.2 Regulated Tanks

There are currently forty-six ASTs located on the Site, many of which were installed in the 1990s. Specific details regarding each of the Tank Farms are provided below.

- Tank Farm A currently consists of ten exterior ASTs, the majority of which are believed to have been in place since the mid-1940s. The secondary containment berm surrounding the tanks was also constructed in the mid-1940s.

- Tank Farm B, consisting of three exterior ASTs, was installed in 1990 with the surrounding concrete containment area.

- Tank Farm C, consisting of thirteen interior ASTs, was installed in 1995 with the surrounding concrete containment area.

- Tank Farm D, consisting of ten interior ASTs, was installed in 1996 with the surrounding concrete containment berm.

- Certain interior ASTs housed in Tank Farm E are believed to have been in place since the mid to late 1940s. The remaining ASTs in Tank Farm E were installed in the mid to late 1970s.

- Three USTs which formerly operated at the Site for the storage of diesel, kerosene, and Stoddard Solvent were decommissioned between 1989 and 1993. No regulated USTs are currently located at the Site.

The ASTs range in capacity from 500-gallons to 30,000-gallons and have a combined oil storage capacity of approximately 306,600 gallons. The ASTs at the Facility are registered with the Oregon State Fire Marshal's office and the COP Fire Department.

Spill prevention measures for the ASTs are regulated by the EPA under 40 Code of Federal Regulations (CFR) Part 112 – Oil Pollution Prevention. In accordance with 40 CFR 112, Christenson Oil has prepared a Spill Prevention Control and Countermeasure (SPCC) Plan for the Facility (Wohlers 2003), and implements the spill prevention measures for the Site in accordance with the SPCC Plan. The particular handling practices for avoiding spills of raw materials and blended products at the Site are described in detail in the SPCC Plan. These measures include: preventing minor spills and/or drips from entering stormwater runoff during the transferring of product to and from ASTs, protection of exterior ASTs within secondary containment structures and within buildings (e.g., Tank Farms C and D). Additionally, Christenson Oil has implemented bulk unloading procedures to avoid spills and prevent pollution. Spill prevention control and countermeasures have been updated as needed over the years of operation.

2.4.3 Hazardous Waste Management

Christenson Oil operations at the Site do not include activities that generate hazardous waste requiring management under state or federal regulations.

2.5 PREVIOUS INVESTIGATIONS

This section presents a summary of the Site's status within the Portland Harbor Superfund Site and summarizes the cleanup action and environmental investigation activities that Christenson Oil has conducted at the Site.

2.5.1 Portland Harbor Superfund Site

On December 1, 2000, the EPA placed a heavily industrialized stretch of the Willamette River (Portland Harbor) on the Superfund National Priorities List (NPL). The EPA sent "Notice of Potential Liability" letters to potentially responsible parties (PRPs) associated with the Portland Harbor Superfund Site, including Christenson Oil. The EPA determined that sediments in the portion of the Willamette River designated as a Superfund Site, as well as soil and groundwater at sites located upland of the river (Upland Sites) within the boundaries of the Portland Harbor, are contaminated with various contaminants of concern (COCs), including metals, polycyclic aromatic hydrocarbons (PAHs), phthalates, polychlorinated biphenyls (PCBs), chlorinated pesticides, total petroleum hydrocarbons (TPH), and dioxins. The DEQ has been authorized to evaluate Upland Sites for potential sources of COCs that may have contributed to contaminated sediment in the Portland Harbor Superfund Site. Within the framework of the Portland Harbor Superfund Site, the Christenson Oil Site is an Upland Site located approximately at River Mile (RM) 8.8 on the west bank of the Willamette River. A chronologic summary of relevant investigation activities is presented below:

- In October 1999, the Site was added to the DEQ Environmental Cleanup Site Information (ECSI) List (ECSI #2426) on the basis of: a history of upland releases at the Site; the location of the Site within the Portland Harbor geographic boundaries; and the stormwater discharge pathway from the Site to Outfall #18 on the Willamette River.

- On July 14, 2000, DEQ requested that Christenson Oil conduct a Preliminary Assessment to assess whether hazardous substances have potentially been released at the Facility and if the releases had the potential to impact the Willamette River sediments.
- The *Pre-Assessment Screen for the Portland Harbor Superfund Site* prepared by the Portland Harbor Natural Resource Trustee Council dated January 2007 identified the COCs for the Christenson Oil Site to include TPH, PAHs, benzene, toluene, ethylbenzene and xylenes (BTEX), copper, lead, and zinc.

2.5.2 Site Investigation and Cleanup

Christenson Oil has conducted cleanup action activities to address releases at the Site and investigation activities to assess the nature and extent of affected soil and groundwater, and to characterize the geologic and hydrogeologic conditions at the Site. The cleanup action activities have included: containment and recovery of released materials; excavation of affected soil; light non-aqueous phase liquid (LNAPL) recovery; and petroleum contaminated groundwater recovery, treatment, and disposal. The investigation activities have included: advancing soil borings; installing groundwater monitoring wells; collecting soil, groundwater, stormwater, and catch basin sediment samples for laboratory analysis; and assessing the results in accordance with industry practice. The tank farms and impervious surfaces are illustrated on Figure 2. A chronologic summary of the cleanup and investigation activities is provided below:

- In October 1975, approximately 1,000 gallons of Bright Stock was released from a transfer valve that was inadvertently left open inside the Main Building. The Bright Stock was collected by the floor drain and reportedly contained upon reaching the intermittent stream. The material was subsequently cleaned up and did not travel off Site (Wohlers 2000).
- In April 1989, Christenson Oil decommissioned and removed one 10,000-gallon capacity UST that previously contained diesel fuel from the Site.
- In October 1990, Petroleum Services Unlimited, Inc. (Petroleum Services) excavated two 10,000-gallon capacity USTs that previously contained kerosene and Stoddard Solvent from their locations southwest of the Storage Building. The USTs were relocated to Tank Farm B and repurposed as ASTs. Laboratory analysis of soil samples collected during the UST decommissioning activities detected concentrations of TPH in the Stoddard Solvent (mineral oil), diesel fuel, and heavy oil ranges. Petroleum Services attributed the detected concentrations of TPH in soil to minor spills associated with operation of the former USTs. Between 1991 and 1993, approximately 116 cubic yards of petroleum affected soil that had been over-excavated during the UST decommissioning was treated on-Site by rototill-assisted aeration. Upon confirmation of successful remediation, the soil was placed as fill in the western portion of the Site. DEQ provided notification to Christenson Oil that cleanup requirements were met in a No Further Action Letter for Leaking USTs dated November 14, 2000.
- In November 1995, approximately 60 gallons of hydraulic oil were released from a dislodged transfer hose to a receiving truck in the loading bay area adjacent to the dispensing area. The release was reported to the COP BES and DEQ through the Oregon Emergency Response System (OERS) (DEQ Spill Number 95-263; OERS Number 95-2221). The spill was contained on three sides by asphalt containment berms. Spill response measures consisted of: immediately applying a drain block over the nearest downstream catch basin, applying absorbent materials to the spill, and collecting residual

liquid with a vacuum truck. The spill response measure prevented the release from leaving the Site and resulted in a *de minimis* determination by DEQ (Wohlers 2000, Wohlers 2006A).

- In September 1998, approximately 715 gallons of bar (chain) oil, or line flush oil, was released as a result of overfilling an AST located in Tank Farm A. The release was reported to OERS (OERS Number 98-2288) and contained within the Tank Farm A secondary containment area. The spill response measures consisted of using a suction pump, absorbent booms, and absorbent pads to recover residual liquids. The used absorbent booms and pads were transported to a waste disposal company for recovery and recycling (Wohlers, 2006A).
- In October 2000, Wohlers submitted a *Voluntary Preliminary Assessment* Report (PA) to DEQ describing the Site background, products and materials used at the Site, and potential contaminant exposure pathways. The PA concluded that historical releases at the Site, Site operations, and existing conditions were not likely to pose a significant impact to human or ecological health associated with groundwater, surface water, air, direct contact, and stormwater discharge at the Site (Wohlers, 2000).
- In August 2001, Wohlers advanced five soil borings at locations within the Tank Farm A containment area, collected shallow soil samples, and submitted the samples for laboratory analysis to assess the residual concentrations of petroleum hydrocarbons related to the September 1998 bar oil release. The laboratory analytical results indicated the highest concentrations of TPH detected in soil samples were present at the surface, and concentrations of TPH in soil samples decreased with depth. The results of the subsurface soil assessment were documented in a *Transmittal of Soil Sampling Results* prepared by Wohlers, dated September 2001.
- In May 2006, a Christenson Oil subcontractor conducted routine concrete floor repair activities in a portion of the Main Building. During the construction activities, petroleum affected soil was encountered beneath a portion of the concrete slab located in the southern corner of the loading dock/storage area. Wohlers conducted oversight during the subsequent excavation of approximately 75 tons of petroleum impacted soil from this location. The excavated soil was transported off-site for disposal at a permitted landfill. Additionally, approximately 4,000 gallons of impacted water was pumped from the open excavation into a 6,500-gallon capacity AST and treated on-Site by air sparging and aeration. The effective treatment of the recovered groundwater was confirmed by laboratory analysis, and the groundwater was discharged from the 6,500-gallon AST to the COP sanitary sewer system on July 11, 2006 upon receipt of a “Batch Discharge Authorization Letter” (Batch No. 2006-034) from the COP BES (Wohlers, 2006A). The excavation oversight included the collection of confirmation soil samples from the excavation sidewalls and the collection of one water sample from within the excavation area for laboratory analysis. Laboratory analysis of the sidewall samples detected diesel and oil range TPH at concentrations ranging from 113 milligrams per kilogram (mg/kg) to 21,200 mg/kg. In June 2006, tightness testing was conducted on the product dispensing line that transferred Stoddard Solvent from an AST in Tank Farm B to the receiving dock. The tightness testing results indicated a gradual leak in the product line between the AST containing Stoddard Solvent and the dispenser located in the loading dock area, which was soon after repaired. The gradual leak in the product line is interpreted as the source of Stoddard Solvent range TPH in soil and groundwater in this localized area of the Site’s

subsurface. The results of the initial response are documented in the XPA, dated December 2006 (Wohlers, 2006A).

- In August 2006, Wohlers conducted further subsurface investigation to assess the areal extent of contamination associated with the Stoddard Solvent release discovered in May 2006. The additional investigation consisted of: advancing nine soil borings (DP-1, DP-2, DP-3, and MW-1 through MW-6); collecting soil samples from the borings for laboratory analysis; completing six of the nine borings as monitoring wells (MW-1 through MW-6); measuring groundwater elevations in the wells; and, collecting groundwater samples from the wells and reconnaissance groundwater samples from the borings for laboratory analysis. The soil and groundwater samples were analyzed for gasoline, diesel and oil range TPH, volatile organic compounds (VOCs), PAHs and total metals (antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, and zinc). Laboratory analysis of soil and groundwater samples detected: TPH in the gasoline, diesel, and oil ranges; select VOCs; select PAHs; barium; chromium; and lead. The results of the investigation are documented in the XPA, dated December 2006 (Wohlers, 2006A). The XPA includes recommendations that a stormwater assessment be conducted in accordance with Portland Harbor JSCS, and that a quarterly groundwater monitoring program be implemented at the Site.

- Quarterly groundwater monitoring and sampling events have been conducted at the Site on the following dates: March 28, 2007; June 28, 2007; September 24, 2007; December 27, 2007; March 31, 2008; June 10, 2008; August 6, 2008; December 31, 2008; March 25, 2009; June 23, 2009; September 22, 2009; December 21, 2009; March 26, 2010; June 24, 2010; September 6, 2010; December 8, 2010; March 10, 2011; June 20, 2011; August 31, 2011; December 20, 2011; March 28, 2012; June 27, 2012; September 19, 2012; December 12, 2012; March 19, 2013; and June 26, 2013. Groundwater monitoring is conducted on a quarterly basis to facilitate the on-going assessment of the nature and distribution of COCs in groundwater at the Site, in accordance with Oregon regulations and DEQ guidance. LNAPL has been measured in well MW-2 since 2007. The results of groundwater monitoring activities indicate petroleum hydrocarbon-related contamination is present in groundwater in the eastern portion of the Site. An assessment of the analytical results for groundwater samples indicates a decreasing trend in petroleum hydrocarbon concentrations over time. Concentrations of metals have been detected in groundwater samples collected throughout the Site. Based the distribution and species of metals detected, the concentrations of metals in groundwater do not appear to be the result of anthropogenic causes. The groundwater monitoring and sampling results have been summarized in reports submitted to the DEQ.

- In the third quarter of 2009, LNAPL mitigation activities were initiated at the Site in accordance with the *Workplan for Limited Environmental Assessment and Interim LNAPL Mitigation* (Pacific Crest, 2009). The LNAPL mitigation activities consisted of the installation of a passive skimmer intended as an interim measure for the recovery of a limited quantity of Stoddard Solvent present as LNAPL in the vicinity of MW-2. Additionally, on June 29, 2010, a dual phase vacuum extraction (DPVE) event was conducted to recover LNAPL and soil vapor containing concentrations of TPH from the vicinity of well MW-2, in accordance with the *DPVE Work Plan* prepared by Pacific Crest, dated March 22, 2010. Well MW-2 is located hydraulically down-gradient, approximately 40 feet east of the inferred source area for the Stoddard Solvent release that discovered in May 2006 (Wohlers, 2006A). Documentation of LNAPL mitigation activities is provided in quarterly progress reports prepared by Pacific Crest.

2.5.3 Stormwater Pathway Evaluation

Under the guidance of DEQ and in accordance with the *Framework for Portland Harbor Storm Water Screening Evaluations* of the *Portland Harbor Joint Source Control Strategy* dated December 2005, Christenson Oil is obligated to facilitate the identification of potential sources of COCs at the Site and to evaluate Site-specific COCs for the stormwater pathway to identify upland sources of contamination that adversely impact, or have the potential to adversely impact, the Willamette River. A chronologic summary of sampling and investigation activities that are related to the characterization of the stormwater pathway at the Site is presented below:

- Between 1998 and April 2008, Christenson Oil conducted stormwater monitoring activities that consisted of: collecting of a minimum of four grab stormwater samples per year; analysis of the samples for TSS, O&G, pH, copper, lead, and zinc; and, monthly visual inspections of representative discharge locations for floating solids and O&G sheen in accordance with the NPDES General Permit. The data collected pursuant to the NPDES General Permit established that the BMPs and SCMs implemented by Christenson Oil were effective at maintaining compliance with stormwater discharge permit benchmarks.
- In 2006 and 2007, Wohlers conducted stormwater and storm drain sediment sampling in accordance with the *Project Workplan – Storm Drain Sediment & Stormwater Sampling*, dated October 2, 2006 (Wohlers, 2006B) as a requirement of the NPDES General Permit. The sampling included the collection of a storm drain sediment samples from catch basin CB-1 in October 2006; and the collection of stormwater samples from the OWS in December 2006, March 2007, and April 2007. The samples were analyzed for TPH, VOCs, semivolatile organic compounds (SVOCs), PCBs, pesticides and total metals.
- In 2008, on the basis of the historical monitoring results, Christenson Oil requested and obtained from DEQ a waiver limiting the stormwater monitoring activities conducted under the NPDES General Permit to monthly visual inspection of O&G sheen and floating solids. The monthly visual monitoring has not reported any observed sheen, odor, or floating solids in catch basin CB-1 over the reporting period.
- In April 2010, Wohlers collected surface water samples from two locations in the intermittent Green Creek, in accordance with the *Workplan for Limited Environmental Assessment and Interim LNAPL Mitigation* (Pacific Crest, 2009). The purpose of the surface water sampling was to evaluate the quality of the surface water as it entered the Site from the up-gradient portion of the Site, and as it entered the influent to the stormwater conveyance system in the down-gradient portion of the Site. The surface water samples were analyzed for TPH, VOCs, SVOCs, PCBs and total metals.

The stormwater drainage both on and adjacent to the Site is illustrated on Figure 4 – Site Drainage Map.

3.0 POTENTIAL SOURCES AND CONTAMINANTS OF INTEREST

The following sections discuss potential sources and COIs at the Site.

3.1 POTENTIAL CONTAMINANT SOURCES

3.1.1 Building Materials

The Main Building is a prefabricated Quonset-style metal building that is constructed of galvanized steel. The galvanized steel material is a potential source of lead (Pb), zinc (Zn), copper (Cu) and iron (Fe) in rainwater that comes into contact with the metal.

3.1.2 Airborne Deposition and Pollen

The Site is located adjacent to a densely wooded section of the Tualatin Mountains. Studies (Perugini et al, 2011) (Botré and Conti, 2001) have documented the propensity of pollen to absorb and bioaccumulate heavy metals, particularly in urban or industrial locations.

3.1.3 Materials and Operations

As discussed previously, materials used in the Facility operations include raw materials and blended products. These include: motor oils, transmission oils, gear oils, hydraulic fluids, bar and chain oils, Stoddard Solvent, kerosene, diesel, and various packaged lubricants. A complete inventory of the volume, storage method, and period of use for each storage tank is provided as Appendix C. If released, these materials represent potential contaminants.

Site operations consist of: selling lubricants and related products manufactured by others and formulation, blending and packaging of specialty lubricants. Products for resale are received either as bulk lubricants or fully pre-packaged products manufactured by other companies, which Christenson Oil offers for sale on a wholesale basis. Pre-packaged products are delivered to the Christenson Oil warehouse located at 3865 NW St. Helens Road and are picked up or delivered to customers upon purchase. Bulk lubricants manufactured by other companies are delivered to 3821 NW St. Helens Road for storage and subsequent sale. Packaging occurs within the Main Building on an assembly line adjacent to Tank Farms C, D and E. Blended products are containerized in tote bins and drums ranging in volume from approximately 16 gallons to 300 gallons in capacity. Containers are filled directly from either a bulk storage AST or a blending AST. Product is metered into the container based on a weight specification. Flow is interrupted automatically as the weight specification is reached.

Packaging of kerosene and Stoddard Solvent into one-gallon and two-gallon containers occurs outside the Main Building. Bulk unloading of kerosene and Stoddard Solvent occurs by gravity feed through piping to a bulk truck located at the receiving dock. Forklifts are used to transport packaged products from trucks.

Raw materials are transported to the Site (3821 NW St. Helens Road) via bulk trucks. A line is then connected from the truck to the appropriate storage tank. Bulk loading and unloading of lubricant product occurs at both the receiving dock and the lubricant dispensing area. Operations at the Site do not include the use, treatment or disposal of any product.

Product at the Site is stored in ASTs located in five tank farms equipped with engineered measures to contain spills and releases. Tank Farms A and B are located outdoors in bermed enclosures which provide secondary containment for potential releases. Tank Farms C and D are located inside the Main Building in bermed enclosures which provide secondary containment for potential releases. The ASTs in Tank Farm E are situated on a concrete slab within the Main Building and the ASTs are equipped with a high level switch and alarm which is connected to a solenoid control valve. The valve is designed to close automatically when tanks are filled above a certain level or upon power loss to the building. Additionally, the blending ASTs in Tank Farm E are typically emptied at the close of each business day. The desired outcome of this SCM is to eliminate the potential for a release or spill to reach an on-Site catch basin or travel outside of the property boundaries in the event of an emergency.

An overview of the secondary containment implementation timeline is provided below:

- The containment area surrounding Tank Farm A was constructed in the mid-1940s.
- The containment area surrounding Tank Farm B was constructed in 1990;
- The containment area surrounding Tank Farm C was constructed in 1995;
- The containment area surrounding Tank Farm D was constructed in 1996;

Proper capacity design and frequent inspection of the secondary containment areas ensures the SCM effectiveness in the event that a significant spill or release should occur at the Site.

Equipment at the Site includes nine company vehicles used for delivery of product to customers, as well as two forklifts. Worn tire tread from forklift and truck tires contain as much as 1% zinc and represent a potential source of contamination.

3.1.4 Historical Releases

Previously discussed historical releases of petroleum hydrocarbons to the surface occurred and were subsequently contained and cleaned up. None of the releases reached the Willamette River. Subsurface releases resulting in impacts to groundwater have occurred at the Site, and if a complete pathway existed between groundwater and the stormwater conveyance system, contaminants could potentially be discharged to the Willamette River. However, as described in Section 2.2, an elevation survey of the current stormwater conveyance system components at the Site indicates that the invert elevations of the shallow flow components of the stormwater system conduits (i.e., catch basin, culverts, inflow and outflow to the OWS) are higher than (and therefore do not intersect) the groundwater table. Because the stormwater system conduits and the groundwater table do not intersect, impacted groundwater cannot enter into the stormwater conveyance system on the Site and there is no complete pathway for groundwater migration to the river. A copy of the map generated by Heritage is provided in Appendix A.

3.2 OUTFALL SEDIMENT DATA

Based on contaminant concentrations in Willamette River sediment samples, Outfall #18 is within a river reach identified by the EPA as an area of potential concern for PCBs, copper, lead, zinc, tributyltin, dichlorodiphenyltrichloroethane (DDT), PAHs and phthalates, and by the Lower Willamette Group (LWG) for PCBs, aldrin, and DDT (COP BES, 2010). In 1997, the EPA conducted an evaluation of sediment contamination within a six mile stretch of the Willamette River, which included the collection of seven sediment samples in the vicinity of Outfall #18 (DEQ, 2000). A summary of the sediment data collected for Outfall #18 is provided as Table 2. The data are inclusive of sampling upstream, downstream, and adjacent to the outfall. A figure depicting sample locations is provided as Appendix D.

3.3 CONTAMINANTS OF INTEREST

The following COIs are of primary concern with relation to the Site:

- TPH as gasoline range organics (GRO), diesel range organics (DRO) and oil range organics (ORO);
- PAHs and phthalates;
- Total metals (arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver and zinc);
- PCB Aroclors;
- Total organic carbon (TOC); and
- TSS.

The COIs for the Site were selected based upon the following criteria: previously identified COCs for the Site; historical and current Site operations; past environmental investigations; materials stored/handled at the Facility; compliance history with regulatory permits; and the contaminants identified in proximity to Outfall #18 in the Willamette River.

4.0 ONGOING STORMWATER MANAGEMENT MEASURES

This section presents a summary of the BMPs being implemented at the Site and mechanisms in place to document these practices and ensure their ongoing implementation and effectiveness. The preventative measures are presented in accordance with the general mitigation categories identified by the DEQ.

4.1 EMPLOYEE EDUCATION AND TRAINING

- Employee spill prevention education and training includes periodic review of the SWPCP Employee Awareness Program to raise employee understanding and awareness of spill prevention and reporting procedures and good housekeeping practices. In addition, the Facility conducts annual employee awareness training as required by the SPCC Plan.
- In the lube dispensing area, drivers are instructed to chock tires, and confirm air pressure release to reduce possible movement at hoses or fittings, and to lay down absorbent materials and drip pans beneath hose connection points. At the completion of operations, drivers are instructed to blow out the hose line to remove free liquid, disconnect the fittings and allow minor quantities of liquid in the hose to drain to the underlying container, and to plug the hoses.
- Drivers loading or unloading product at the receiving dock are instructed to chock their tires prior to initiating loading/unloading.
- Spill response procedures and emergency instructions are posted at several strategic locations throughout the Facility.
- A notebook containing copies of the SWPCP, SPCC, maintenance reports, regular inspection checklists, records of any leaks/spills and related corrective actions, is maintained at the Site and is available for review by Facility personnel and authorized regulatory representatives.

4.2 DEBRIS REMOVAL

- The two stage filters installed in catch basin CB-1, and the OWS are cleaned and/or maintained on a semi-annual schedule, generally in the spring and fall.
- Paved areas are swept on a quarterly schedule to reduce the quantity of sediment and debris entering the stormwater conveyance system.
- Facility-wide inspections are conducted on a monthly basis, including the critical points of the stormwater drainage system, product storage areas (tank farms), container storage area, parking areas, and maintenance equipment and spill response storage areas.

4.3 EXPOSURE REDUCTION

- Product at the Site is stored in ASTs located in five tank farms equipped with engineered measures to contain spills and releases. Tank Farms A and B are located outdoors in bermed enclosures providing secondary containment for potential releases. Tank Farms C and D are located inside the Main Building also in bermed enclosures providing secondary containment for potential releases. The ASTs in Tank Farm E are situated on a concrete slab within the Main Building. The ASTs in Tank Farm E are equipped with a high level switch and alarm connected to a solenoid control valve designed to close automatically when the tanks are filled above a specified level, or upon power loss to the building. The blending ASTs in Tank Farm E are typically emptied at the close of each business day.

- Drums and other product containers are stored in covered areas of the Site, protected from precipitation, and out of the direct pathway of stormwater.
- Spill cleanup equipment (pads, booms, snakes, clay, drain mats, etc.) is maintained in easily accessible locations proximate to work areas where minor leaks or spills may occur to facilitate immediate containment and cleanup.
- At loading connection points, drip containers are utilized to catch minor spills.
- Vehicle washing is not permitted at the Site.

4.4 RUNOFF DIVERSION

Stormwater runoff diversion structures (e.g. gutters, drains, dikes, and graded pavement) collect and divert runoff to minimize the potential for contamination of stormwater and receiving waters. Stormwater runoff from the operations area of the Facility is directed by gutters and graded pavement toward catch basin CB-1. Catch basin CB-1 is equipped with a two-stage filter insert and is the only catch basin that receives stormwater from impervious surfaces on the Site. Filtered stormwater from catch basin CB-1 flows to an underground OWS prior to discharging to the COP shared conveyance system.

5.0 DATA COLLECTION AND INTERPRETATION

Data was collected for the SCE in general accordance with the DEQ approved *Draft Source Control Evaluation Work Plan* (SCE Work Plan) dated April 13, 2011 (Pacific Crest, 2011). The following sampling was conducted as part of the SCE:

- Catch basin sediment sampling on December 1, 2010;
- Stormwater sampling on November 16, 2011, January 29, 2012, March 5, 2012, and May 21, 2012; and
- OWS sediment sampling on September 20, 2012.

The quality of the sampling activities and results was assessed in accordance with the SCE Quality Assurance Project Plan (SCE QAPP) that was developed in accordance with the *Guidance on Quality Assurance Project Plans* (EPA, 2002) and is provided as Appendix E of the SCE Work Plan. The quality assurance activities consisted of data review, verification, and validation. The purpose of the verification and validation procedures was to assess whether the data conform to established project requirements and to determine if limitations exist if data do not conform to the project requirements, data quality objectives, and/or method-specific requirements.

Verification of sampling information and chemical data occurred at several levels throughout the course of sample collection and analysis. Data verification is the process of determining whether data have been collected or generated according to a sampling and analysis plan and the respective SOPs or method descriptions. Data verification consisted of the following categories: verification of compliance with the SOP and SCE Work Plan; verification of correctness to determine that the data collection plans and protocols were followed; and verification of completeness of the data sets and supporting documentation to confirm that all data necessary to meet the sampling objectives have been collected.

Analytical data were validated after the field activities were completed, the results reported by the laboratory were available, and all data were verified. Data validation requirements were completed prior to use of the data for interpretive activities. Data validation is the process of evaluating the technical usability of the verified data with respect to the planned objectives of the project. Data validation consisted of the following objectives: verifying that field and laboratory measurements were appropriate for sampling objectives; providing information to the data user regarding data quality by assignment of individual data qualifiers based on the associated degree of variability; and determining whether data quality objectives were met.

Data validation procedures included evaluating the sample results and applicable quality control measurement results reported by the laboratories. Analytical data were validated in accordance with guidance specified by the EPA in the context of method-specific and laboratory-established quality control requirements, as applicable.

All SCE data has been subjected to two levels of a quality assurance/quality control (QA/QC) evaluation: one by the laboratory for all analytical data, and one by Pacific Crest for both analytical and field data. The laboratory performed the initial data reduction, evaluation, and reporting in accordance with the Friedman & Bruya *Quality Assurance Manual*, provided as Appendix A of the SCE QAPP. The analytical data was then validated by Pacific Crest.

5.1 SAMPLING

The following sections present the methodologies employed during the collection and analysis of representative sediment and stormwater samples collected from the catch basin and OWS servicing the Site.

Historical sampling of catch basin sediment, stormwater, and surface water has been conducted at the Site for purposes unrelated to the SCE. The data have been provided to the DEQ in previously submitted reports and are also summarized in Tables 1 and 3.

5.1.1 Catch Basin Sediment Sampling

Sampling Framework

The purpose of the catch basin sediment sampling was to provide further data to establish Site-specific stormwater discharge COCs. Two samples were collected from catch basin CB-1. Laboratory analysis of the fine-grained sediments assisted in the identification of COIs that may not be detected in stormwater, such as hydrophobic PCBs and SVOCs. Sediment sampling results, in conjunction with historic catch basin sediment sampling data that exists for the Site, have assisted in the evaluation of the on-going effectiveness of SCMs and BMPs implemented at the Site.

Sampling Location Rationale

The rationale for selecting catch basin CB-1 as the sample location is presented below:

- Stormwater runoff from impervious surfaces in portions of the Site where industrial activities are conducted is diverted to catch basin CB-1, which serves as the representative catch basin sediment sampling location.

- Catch basin CB-1 is located near the eastern portion of the Site and east of the receiving/loading dock area of the Site (Figure 2). Catch basin CB-1 is the approved catch basin sediment sampling location that is used to satisfy the requirements of the NPDES General Permit.

- Catch basins CB-2 and CB-3, located in the right-of-way of NW St. Helens Road, are not representative of stormwater from the Site due to the collection of runoff from the NW St. Helens Road, and do not receive stormwater flow from areas where product blending, transfer, or storage operations are conducted.

A Catch Basin Sediment Sample Location Summary is provided as Table 4.

Analytical Suite Rationale

In accordance with the SCE Work Plan, catch basin sediment samples were analyzed based upon previously identified COIs for the Site; historical and current Site operations; past environmental investigations; materials stored/handled at the Facility; compliance history with regulatory permits; and the COCs related to Outfall #18 on the Willamette River. On the basis of these criteria, the following COIs were of primary concern:

- TPH as GRO by Northwest Method NWTPH-Gx;
- TPH as DRO and ORO by Northwest Method NWTPH-Dx;
- PAHs and phthalates by EPA Method 8270D SIM;
- Total Metals (arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver and zinc) by EPA Method 200.8;
- SVOCs by EPA Method 8270D; and
- PCB Aroclors by EPA Method 8082A.

Catch basin sediment samples were also analyzed for TOC (Method SW-846 9060), TSS (Method SM 2540G), and grain size distribution (Method ASTM D422).

Sampling Schedule

Catch basin sediment sampling was conducted prior to the stormwater sampling events and was used to develop an appropriate analytical suite for the stormwater samples. Christenson Oil conducts biannual sediment removal from catch basin CB-1 in the spring and fall. Catch basin sediment samples were collected prior to catch basin sediment removal to ensure sufficient sediment availability.

Sampling Collection Methodology

Catch basin sediment sampling was conducted in accordance with sample collection and documentation procedures described in *Standard Operating Procedures: Guidance for Sampling of Catch Basin Solids*, developed by the COP BES. The SOP provides detailed information regarding equipment and materials, procedures, sample acceptability, documentation, quality assurance, and quality control.

Sample collection included obtaining samples from both the filter fabric and the bottom of the catch basin. Samples were assigned a unique sample identifier which includes the following:

- Sample Medium (Sed);
- Sample location (CB-1);
- Sample position in catch basin (filter [F] or bottom [B]); and
- Sample date (mm/dd/yy).

Following collection, sediment samples were placed into appropriate containers supplied by the analytical laboratory. The sample containers were placed into a cooler and submitted to Friedman & Bruya, Inc. of Seattle, Washington (Friedman & Bruya), an Oregon Environmental Laboratory Accreditation Program analytical laboratory, under standard chain-of-custody protocol.

Documentation

Sampling of catch basin filter fabric and sediment from catch basin CB-1 was conducted under the direction of Wohlers field personnel on December 1, 2010. The catch basin sediment sampling event was conducted in accordance with both the SCE Work Plan and the *Standard Operating Procedures: Guidance for Sampling of Catch Basin Solids* (Catch Basin Sampling SOP) developed by the COP BES. No deviations from the SCE Work Plan or the Catch Basin Sampling SOP were reported by Wohlers field personnel.

Pacific Crest reviewed field records, observations and measurements to ensure that procedures were properly followed and documented. The review included:

- Verification of completeness and legibility of field reports and sampling forms;
- Collection and preparation of field quality control samples;
- Equipment calibration and maintenance; and
- Completion of Chain-of-Custody forms.

The laboratory identified the following data quality issue in its QA/QC assessment of the catch basin sample analysis:

- The 8260C relative percent difference from the laboratory control sample and laboratory control sample duplicate analysis was outside of control limits for several compounds. The compounds were not detected, therefore the data were considered acceptable.

Pacific Crest identified the following data quality issues in its QA/QC assessment:

- 3,3-dichlorobenzidine and n-nitrosodimethylanine were not included in the analyte list for SVOC analysis and analytical results are not available. Neither compound is common. The missing data does not change the SCE conclusions.
- SVOC analysis for both samples collected from catch basin CB-1 required dilution by the laboratory in order to complete the analysis, and, as a result, laboratory method detection limits (MDLs) were elevated. The MDLs exceeded the SLVs for 1,3-dichlorobenzene; 1,4-dichlorobenzene; hexachlorobutadiene; hexachlorocyclopentadiene; phenol; 2, 4, 6- trichlorophenol; pentachlorophenol; diethyl phthalate; and, di-n-butyl phthalate. The data is considered usable because SVOCs, other than phthalates, are not the primary COIs for the Site.

5.1.2 Stormwater Sampling

Sampling Framework

The purpose of collecting one stormwater sample (four samples total) during four separate storm events was to provide information on the types and concentrations of COIs in stormwater effluent discharged from the Site to evaluate potential effects to the receiving waterbody.

Sampling Location Rationale

The rationale for selecting a location upstream of the connection between the Site stormwater system and the shared stormwater conveyance system as the sample location is presented below:

- Catch basin CB-1 collects stormwater from impervious surfaces in Basin A and subsurface utility piping conveys the stormwater to the OWS, which separates oil and suspended solids from the stormwater before discharging stormwater to the shared storm sewer conveyance system located in NW St. Helens Road.

- Due to the conveyance of stormwater on the Site, the OWS point of discharge is representative of stormwater leaving the Site.

Analytical Suite Rationale

In accordance with the SCE Work Plan, stormwater samples were analyzed based on previously identified COIs for the Site; historical and current Site operations; past environmental investigations; materials stored/handled at the Facility; compliance history with regulatory permits; and the COCs related to Outfall #18 on the Willamette River.

The stormwater samples were analyzed for the following COIs:

- TPH as GRO by Northwest Method NWTPH-Gx;
- TPH as DRO and ORO by Northwest Method NWTPH-Dx;
- PAHs and phthalates by EPA Method 8270D SIM;
- Total metals (arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver and zinc) by EPA Method 200.8;
- SVOCs by EPA Method 8270D; and
- PCB Aroclors by EPA Method 8082A.

The stormwater samples were also analyzed for TOC (Method SM 5310B) and TSS (Method 2540D).

5.1.3 Sampling Collection Methodology

Stormwater sampling events were completed with the following criteria:

- Each stormwater event was preceded by a 24-hour dry period (less than 0.1 inches of accumulative rainfall);
- A minimum rainfall of 0.2-inches occurred during an event having a minimum duration of 3 hours; and
- All four samples were identified by Wohlers as being collected during representative “first flush” conditions of the storm event (i.e., stormwater samples were collected within the first 30 minutes of stormwater discharge from the Site).

Hydrograph rainfall data was collected from the USGS Yeon Street rain gauge located at 3395 NW Yeon Street in Portland, Oregon.

Stormwater samples were collected as grab samples at discrete time intervals. Sampling was conducted in accordance with the Washington State Department of Ecology (Ecology) guidance document *Standard Operating Procedure for Collecting Grab Samples from Stormwater Discharges* (Stormwater SOP), dated September 16, 2009.

The samples were assigned a unique sample identifier which includes the following:

- Sample Medium (SW);
- Sample location (OWS);

- Sample position in OWS (effluent [EF]); and
- Sample date (mm/dd/yy).

For example, the stormwater sample collected from the OWS effluent on May 21, 2012 has the identifier: SW-OWS-EF-052112.

Following collection, stormwater samples were placed into appropriate containers supplied by the analytical laboratory. The sample containers were then placed into a cooler and submitted to Friedman & Bruya under standard chain-of-custody protocol.

Documentation

Stormwater sampling was conducted under the direction of Wohlers field personnel on the following dates: November 16, 2011; January 29, 2012; March 5, 2012; and May 21, 2012. The stormwater sampling was conducted in accordance with the Stormwater SOP and the SCE Work Plan. No deviations from the SCE Work Plan or the SOP were reported by Wohlers field personnel. The following table includes the duration of the antecedent dry period for each of the sampled storm events.

Sample ID	Antecedent Dry Period (hours)
SW-OWS-EF-111611	394
SW-OWS-EF-012912	97
SW-OWS-EF-030512	76
SW-OWS-EF-052112	79

Hydrographs for the storm events showing the rainfall distribution for the time period beginning 24 hours prior to the storm events through the completion of the event is provided as Figure 6.

Pacific Crest reviewed field records, observations and measurements to ensure that procedures were properly followed and documented. The review included:

- Verification of completeness and legibility of field reports and sampling forms;
- Collection and preparation of field quality control samples;
- Equipment calibration and maintenance; and
- Completion of Chain-of-Custody forms.

Laboratory analytical reports for each of the stormwater samples reported the following with regard to the QA/QC assessment:

- SW-OWS-EF-111611:
    - The 8270D calibration standard failed the acceptance criteria for fluorene. In addition, the laboratory control sample and laboratory control sample duplicate failed below the acceptance criteria for fluorene. The results are flagged accordingly.
    - The 8270D n-nitrosodimethylamine laboratory control sample and laboratory control sample duplicate failed below the acceptance criteria. The results are flagged accordingly.

- The 8260C laboratory control sample and laboratory control sample duplicate failed the relative percent difference for benzoic acid. The analyte was not detected therefore the data were acceptable.
- The sample was sent to Amtest, Inc. of Kirkland, Washington (Amtest) for the TOC analysis. Review of the report indicated that all quality assurance data were acceptable.

- SW-OWS-EF-012912:
  - Several compounds in the 8270D laboratory control sample and laboratory control sample duplicate failed the acceptance criteria. The results are flagged accordingly.
  - The sample was sent to Aquatic Research, Inc. of Seattle, Washington (Aquatic Research) for the TOC analysis. Review of the report indicated that all quality assurance data were acceptable.
- SW-OWS-EF-030512:
  - Chrysene in the laboratory control sample duplicate failed the acceptance criteria. The data were flagged accordingly.
  - The sample was sent to Amtest for the TOC analysis. Review of the report indicated that all quality assurance were acceptable.
- SW-OWS-EF-052112:
  - The sample was sent to Amtest for the TOC analysis. Review of the report indicated that all quality assurance were acceptable.

Pacific Crest's review of the QA/QC measures indicates the following:

- The sampling objectives were met.
- The following analytes were identified to have a laboratory method reporting limits (MRLs) exceeding the JSCS SLV in stormwater during one or more sampling events: hexachlorobenzene, hexachlorocyclopentadiene, bis-(2-chloroethyl)ether, 4-chlorophenyl-phenyl ether, 3,3'-dichlorobenzidine, 4-nitroanaline, n-nitrosodimethylamine, n-nitroso-di-n-propylamine, pentachlorophenol, BEHP, 2-methylnapthalene, Aroclor #1221, Aroclor #1232, Aroclor #1242, Aroclor #1248, Aroclor #1254, Aroclor #1260 and arsenic. The MRLs were consistent with the target MRLs presented in the SCE Workplan.
- Wohlers field personnel noted the presence of tree pollen in the stormwater sample SW-OWS-EF-052112, and on the surface of the water in the OWS. Tree pollen was not noted during previous sampling events. The presence of tree pollen in stormwater sample SW-OWS-EF-052112 increases the level of uncertainty regarding the nature and sources of the concentrations of metals detected in the sample, but does not affect the representativeness of the sample. Further discussion regarding the presence of pollen in sample SW-OWS-EF-052112 is included in Section 5.3.3.
- The representativeness of the samples are not affected by unusual activities occurring on the site prior to the sampling event; unusually long or short antecedent dry periods; timing of sample collection during each storm event or volume and intensity of rainfall during each storm event.

5.1.4 Oil Water Separator Sediment Sampling

Sampling of accumulated sediment within the on-Site OWS was conducted at the request of DEQ and was not a work scope item in the SCE Work Plan. The OWS sediment sampling was conducted in a manner consistent with catch basin sediment sampling methodology presented in the SCE Work Plan.

Sampling Framework

The purpose of the OWS sediment sampling was to assess the nature of the fine grained sediment that could potentially be discharged from the Site during a high flow storm event. One sample of sediment was collected from the OWS for laboratory analysis.

Sampling Location Rationale

The rationale for the sampling location is presented below:

- The OWS consists of three internal compartments (influent, middle, and effluent bay), which assist in the separation of oil and TSS from stormwater. Sediment from the middle bay of the OWS is most likely to be representative of material that could potentially be discharged during a high flow storm event.

Analytical Suite Rationale

The OWS sediment samples were analyzed based upon previously identified COIs for the Site; historical and current Site operations; past environmental investigations; materials stored/handled at the Facility; compliance history with regulatory permits; and the COCs related to Outfall #18 on the Willamette River.

The sediment sample was analyzed for the following COIs:

- TPH as GRO by Northwest Method NWTPH-Gx;
- TPH as DRO and ORO by Northwest Method NWTPH-Dx;
- PAHs and phthalates by EPA Method 8270D SIM;
- Total Metals (arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver and zinc) by EPA Method 200.8; and,
- PCB Aroclors by EPA Method 8082A.

OWS sediment samples were also analyzed for TOC (Method SW-846 9060), sample moisture, and grain size distribution (Method ASTM D422).

Sample Collection Methodology

OWS sediment sampling was conducted in accordance with sample collection and documentation procedures described in *Standard Operating Procedures: Guidance for Sampling of Catch Basin Solids* developed by the COP BES. The SOP provides detailed information regarding equipment and materials, procedures, sample acceptability, documentation, quality assurance, and quality control.

Following collection, the sediment sample was placed into appropriate containers supplied by the analytical laboratory. The sample container was placed into a cooler and submitted to Friedman & Bruya under standard chain-of-custody protocol.

The sample was assigned a unique sample identifier which includes the following:

- Sample Medium (SED);
- Sample location (OWS);
- Sample number (1); and,
- Sample date (mm/dd/yy).

The sediment sample collected from the middle bay of the OWS on September 20, 2012 has the identifier: SED-OWS-1-092012.

Documentation

OWS sediment sampling was conducted under the direction of Wohlers field personnel on September 20, 2012. The OWS sediment sampling was conducted in accordance with the Catch Basin Sampling SOP, as applicable. Due to an unintentional oversight by field personnel, SED-OWS-1-092012 was not analyzed for SVOCs by EPA Method 8270D. Consideration was given to resample the OWS sediment in order to analyze for SVOCs, more specifically phthalates; however, it was ultimately decided that the SVOC analysis alone did not warrant the collection of an additional sediment sample based on the historically low detection occurrence for SVOCs.

Pacific Crest reviewed field records, observations and measurements to ensure that procedures were properly followed and documented. The review included:

- Verification of completeness and legibility of field reports and sampling forms;
- Collection and preparation of field quality control samples;
- Equipment calibration and maintenance; and
- Completion of Chain-of-Custody forms.

The laboratory analytical report for sediment sample SED-OWS-1-092012 reported the following with regard to the QA/QC assessment:

- The sample was sent to Fremont Analytical of Seattle, Washington for the TOC and grain size analyses. Review of the report indicated that all quality assurance were acceptable.

All quality control requirements were acceptable.

5.2 DATA SUMMARY

5.2.1 Catch Basin Sediment Data Summary

5.2.1.1 SED-CB-1-F-120110

Laboratory analytical results for catch basin filter sediment sample SED-CB-1-F-120110 are summarized as follows:

- Laboratory analysis detected a concentration of indeno(1,2,3-cd)pyrene of 0.18 mg/kg, exceeding the JSCS SLV for indeno(1,2,3-cd)pyrene of 0.1 mg/kg.
- Laboratory analysis detected a concentration of cadmium of 1.56 mg/kg, exceeding the JSCS SLV for cadmium of 1 mg/kg.
- Laboratory analysis detected a concentration of lead of 50.2 mg/kg, exceeding the JSCS SLV for lead of 17 mg/kg.
- Laboratory analysis detected a concentration of bis(2-ethylhexyl)phthalate (BEHP) of 32 mg/kg, exceeding the JSCS SLV for BEHP of 0.33 mg/kg.
- Based on the dry weight of the sample, total solids equaled 41.7%.
- TOC was detected at a concentration of 5.8%.
- Grain size distribution analysis results indicate the sample consisted of: sand (65.0%), gravel (19.4%), silt (12.8%), and clay (2.70%).

Concentrations were either not detected at or above the SLVs or were not detected above the laboratory MDL for the remaining COIs analyzed in sample SED-CB-1-F-120110.

5.2.1.2 SED-CB-1-B-120110

Laboratory analytical results for the catch basin bottom sediment sample SED-CB-1-B-120110 are summarized as follows:

- Laboratory analysis detected a concentration of benzo(g,h,i)perylene of 0.37 mg/kg, exceeding the JSCS SLV for benzo(g,h,i)perylene of 0.3 mg/kg.
- Laboratory analysis detected a concentration of indeno(1,2,3-cd)pyrene of 0.28 mg/kg, exceeding the JSCS SLV for indeno(1,2,3-cd)pyrene of 0.1 mg/kg.
- Laboratory analysis detected a concentration of cadmium of 2.87 mg/kg, exceeding the JSCS SLV for cadmium of 1 mg/kg.
- Laboratory analysis detected a concentration of lead of 84.6 mg/kg, exceeding the JSCS SLV for lead of 17 mg/kg.
- Laboratory analysis detected a concentration of zinc of 584 mg/kg, exceeding the JSCS SLV for zinc of 459 mg/kg.
- Laboratory analysis detected a concentration of BEHP of 38 mg/kg, exceeding the JSCS SLV for BEHP of 0.33 mg/kg.
- Based on the dry weight of the sample, total solids equaled 42.6%.
- TOC was detected at a concentration of 7.4%.
- Grain size distribution consisted of sand (79.2%), silt (18.1%), gravel (1.60%) and clay (1.20%).

Concentrations were either not detected at or above the SLVs or were not detected above the laboratory MDL for the remaining COIs analyzed in sample SED-CB-1-B-120110. The catch basin sediment sampling location and analytical results are presented on Figures 7 through 9.

Summarized analytical data is provided in Table 5. Laboratory analytical reports are provided in Appendix E.

5.2.2 Stormwater Data Summary

5.2.2.1 SW-OWS-EF-111611

Laboratory analytical results for the stormwater sample collected on November 16, 2011 (SW-OWS-EF-111611) are summarized as follows:

- Laboratory analysis detected a concentration of cadmium of 0.194 µg/l, exceeding the JSCS SLV for cadmium of 0.094 µg/l.
- Laboratory analysis detected a concentration of copper of 5.04 µg/l, exceeding the JSCS SLV for copper of 2.7 µg/l.
- Laboratory analysis detected a concentration of lead of 3.70 µg/l, exceeding the JSCS SLV for lead of 0.54 µg/l.
- Laboratory analysis detected a concentration of nickel of 1.28 µg/l, exceeding the JSCS SLV for nickel of 0.0028 µg/l.
- Laboratory analysis detected a concentration of zinc of 116 µg/l, exceeding the JSCS SLV for zinc of 36 µg/l.
- TOC was detected at a concentration of 3.5 mg/l.
- TSS were detected at a concentration of 14 mg/l.

Concentrations were either not detected at or above the SLVs or were not detected above the laboratory MDL for the remaining COIs analyzed in sample SW-OWS-EF-111611.

5.2.2.2 SW-OWS-EF-012912

Laboratory analytical results for the stormwater sample collected on January 29, 2012 (SW-OWS-EF-012912) are summarized as follows:

- Laboratory analysis detected a concentration of cadmium of 0.213 µg/l, exceeding the JSCS SLV for cadmium of 0.094 µg/l.
- Laboratory analysis detected a concentration of copper of 3.28 µg/l, exceeding the JSCS SLV for copper of 2.7 µg/l.
- Laboratory analysis detected a concentration of lead of 2.29 µg/l, exceeding the JSCS SLV for lead of 0.54 µg/l.
- Laboratory analysis detected a concentration of zinc of 121 µg/l, exceeding the JSCS SLV for zinc of 36 µg/l.
- TOC was detected at a concentration of 1.27 mg/l.
- TSS were not detected above the MDL.

Concentrations were either not detected at or above the SLVs or were not detected above the laboratory MDL for the remaining COIs analyzed in sample SW-OWS-EF-012912.

5.2.2.3 SW-OWS-EF-030512

Laboratory analytical results for the stormwater sample collected on March 5, 2012 (SW-OWS-EF-030512) are summarized as follows:

- Laboratory analysis detected a concentration of benzo(a)anthracene of 0.021 µg/l, exceeding the JSCS SLV for benzo(a)anthracene of 0.018 µg/l.
- Laboratory analysis detected a concentration of chrysene of 0.030 µg/l, exceeding the JSCS SLV for chrysene of 0.018 µg/l.
- Laboratory analysis detected a concentration of benzo(b)fluoranthene of 0.033 µg/l, exceeding the JSCS SLV for benzo(b)fluoranthene of 0.018 µg/l.
- Laboratory analysis detected a concentration of benzo(a)pyrene of 0.025 µg/l, exceeding the JSCS SLV for benzo(a)pyrene of 0.018 µg/l.
- Laboratory analysis detected a concentration of indeno(1,2,3-cd)pyrene of 0.033 µg/l, exceeding the JSCS SLV for indeno(1,2,3-cd)pyrene of 0.018 µg/l.
- Laboratory analysis detected a concentration of cadmium of 0.159 µg/l, exceeding the JSCS SLV for cadmium of 0.094 µg/l.
- Laboratory analysis detected a concentration of copper of 4.12 µg/l, exceeding the JSCS SLV for copper of 2.7 µg/l.
- Laboratory analysis detected a concentration of lead of 2.36 µg/l, exceeding the JSCS SLV for lead of 0.54 µg/l.
- Laboratory analysis detected a concentration of zinc of 111 µg/l, exceeding the JSCS SLV for zinc of 36 µg/l.
- TOC was detected at a concentration of 5.1 mg/l.
- TSS were not detected above the MDL.

Concentrations were either not detected at or above the SLVs or were not detected above the laboratory MDL for the remaining COIs analyzed in sample SW-OWS-EF-030512.

5.2.2.4 SW-OWS-EF-052112

Laboratory analytical results for the stormwater sample collected on May 21, 2012 (SW-OWS-EF-052112) are summarized as follows:

- Laboratory analysis detected arsenic at a concentration of 0.763 µg/l, exceeding the JSCS SLV for arsenic of 0.045 µg/l.
- Laboratory analysis detected cadmium at a concentration of 0.649 µg/l, exceeding the JSCS SLV for cadmium of 0.094 µg/l.
- Laboratory analysis detected copper at a concentration of 12.7 µg/l, exceeding the JSCS SLV for copper of 2.7 µg/l.
- Laboratory analysis detected lead at a concentration of 2.45 µg/l, exceeding the JSCS SLV for lead of 0.54 µg/l.

- Laboratory analysis detected nickel at a concentration of 3.08 µg/l, exceeding the JSCS SLV for nickel of 0.0028 µg/l.
- Laboratory analysis detected zinc at a concentration of 291 µg/l, exceeding the JSCS SLV for zinc of 36 µg/l.
- TOC was detected at a concentration of 27 mg/l.
- TSS were not detected above the laboratory MDL.

For the remaining COCs analyzed in sample SW-OWS-EF-052112, analyte concentrations were either not detected at or above the laboratory MDL, or the COCs were detected at concentrations below the corresponding JSCS SLV.

Stormwater sampling locations and analytical results are presented on Figures 10 through 12. Summarized analytical data is provided in Table 6. Laboratory analytical reports are provided in Appendix E.

5.2.3 Oil Water Separator Sediment Data Summary

Laboratory analytical results for OWS sediment sample SED-OWS-1-092012 are summarized as follows:

- Laboratory analysis detected a concentration of indeno(1,2,3-cd)pyrene of 0.42 mg/kg, exceeding the JSCS SLV for indeno(1,2,3-cd)pyrene of 0.1 mg/kg.
- Laboratory analysis detected a concentration of benzo(g,h,i)perylene of 0.43 mg/kg, exceeding the JSCS SLV for benzo(g,h,i)perylene of 0.3 mg/kg.
- Laboratory analysis detected a concentration of zinc of 752 mg/kg, exceeding the JSCS SLV for zinc of 459 mg/kg.
- Based on the dry weight of the sample, total solids equaled 39.7%.
- TOC was detected at a concentration of 13.8%.

For the remaining COCs analyzed in sample SED-OWS-1-092012, analyte concentrations were either not detected at or above the laboratory MDL, or the COCs were detected at concentrations below the corresponding JSCS SLV.

The OWS sediment sampling location and analytical results are presented on Figures 13 through 15. Summarized analytical data is provided in Table 5. The laboratory analytical report is provided in Appendix E.

5.3 DATA INTERPRETATION

5.3.1 Method Detection Level and QA/QC

The following analytes were identified to have a laboratory MDL exceeding the JSCS SLV in sediment:

- 1,3-dichlorobenzene, 1,4-dichlorobenzene, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, phenol, pentachlorophenol, diethyl phthalate, di-n-butyl phthalate, and mercury.

The following analytes were identified to have a laboratory MDL exceeding the JSCS SLV in stormwater:

- Hexachlorobenzene, hexachlorocyclopentadiene, bis-(2-chloroethyl)ether, 3,3'-dichlorobenzidine, 4-nitroanaline, n-nitrosodimethylamine, n-nitroso-di-n-propylamine, pentachlorophenol, BEHP, 2-methylnapthalene, Aroclor #1221, Aroclor #1232, Aroclor #1242, Aroclor #1248, Aroclor #1254, Aroclor #1260 and arsenic.

5.3.2 SLV Exceedances

The following table summarizes the SLV exceedances in the SCE data:

Catch Basin Sediment			
Sample ID	COC	Concentration (mg/kg)	Magnitude of SLV Exceedance
SED-CB-1-F-120110	Bis(2-ethylhexyl)phthalate	32	96.97
	Indeno(1,2,3-cd)pyrene	0.18	1.8
	Cadmium	1.56	1.56
	Lead	50.2	2.95
SED-CB-1-B-120110	Bis(2-ethylhexyl)phthalate	38	115.15
	Indeno(1,2,3-cd)pyrene	0.28	2.8
	Benzo(g,h,i)perylene	0.37	1.23
	Cadmium	2.87	2.87
	Lead	84.6	4.98
	Zinc	584	1.27
OWS Sediment			
Sample ID	COC	Concentration (mg/kg)	Magnitude of SLV Exceedance
SED-OWS-1-092012	Indeno(1,2,3-cd)pyrene	0.42	4.2
	Benzo(g,h,i)perylene	0.43	1.43
	Zinc	752	1.64
Stormwater			
Sample ID	COC	Concentration (µg/l)	Magnitude of SLV Exceedance
SW-OWS-EF-111611	Cadmium	0.194	2.06
	Copper	5.04	1.87
	Lead	3.7	6.85
	Nickel	1.28	457.14
	Zinc	116	3.22
SW-OWS-EF-012912	Cadmium	0.213	2.27
	Copper	3.28	1.21
	Lead	2.29	4.24
	Zinc	121	3.36
SW-OWS-EF-030512	Benzo(a)anthracene	0.021	1.17
	Chrysene	0.03	1.67
	Benzo(b)fluoranthene	0.033	1.83
	Benzo(a)pyrene	0.025	1.39
	Indeno(1,2,3-cd)pyrene	0.033	1.83
	Cadmium	0.159	1.69
	Copper	4.12	1.53
	Lead	2.36	4.37
	Zinc	111	3.08
SW-OWS-EF-052112	Arsenic	0.763	16.96
	Cadmium	0.649	6.9
	Copper	12.7	4.7
	Lead	2.45	4.54
	Manganese	230	4.6
	Nickel	3.08	1,100
	Zinc	291	8.08

Note: the magnitude of exceedance was determined by dividing the detected concentration by the applicable SLV.

5.3.3 Discussion

In general, SCE data trends are indicative of typical stormwater discharges associated with light industrial activities. Minor exceedances of a limited number of COIs observed in the SCE data are reflective of the conservative nature of the JSCS SLVs, rather than the inadequacy of stormwater SCMs and BMPs at the Site. Data uncertainty regarding SVOCs in oil-water sediment and metals in stormwater are discussed in further detail below:

- Due to an unintentional oversight by field personnel, sediment sample SED-OWS-1-092012 was not analyzed for SVOCs by EPA Method 8270D. Consideration was given to resample the OWS sediment in order to analyze for SVOCs, more specifically phthalates; however, it was ultimately decided that the SVOC analysis alone did not warrant the collection of an additional sediment sample based on the historically low detection occurrence for SVOCs. Catch basin sediment samples detected concentrations of BEHP which exceeded the JSCS SLV for BEHP; however, in comparison to Risk-Based Concentration Levels based on various receptor scenarios for direct and indirect pathways, the concentrations detected at the Site appear to be of minimal concern. Furthermore, BEHP was not detected in any of the stormwater samples.
- Laboratory analysis of stormwater sample SW-OWS-EF-052112 detected certain heavy metals at elevated concentrations relative to results from previous sampling events. The field sampling technician noted the unusual presence of pollen in the stormwater sample. Studies (Perugini et al, 2011) (Botré and Conti, 2001) have documented the propensity of pollen to absorb and bioaccumulate heavy metals, particularly in urban or industrial locations. The anomalous concentrations of metals detected in stormwater sample SW-OWS-EF-052112 appear to be attributable to the presence of pollen in the stormwater sample rather than to anthropogenic sources at the Site.

6.0 SOURCE CONTROL MEASURES

This section presents a description of SCMs implemented at the Site to minimize exposure and remove potential sources from the stormwater pathway prior to discharging from the Site. SWPPCMs include those measures presented in the SWPCP as well as additional engineered controls implemented since the SWPCP was adopted in 2001. The SWPCP was prepared in accordance with the requirements of the NPDES General Permit issued for the Site. The SWPCP includes a spill prevention and response plan, BMPs and SCMs designed to minimize the potential for released pollutants to enter the stormwater pathway, or to remove pollutants from stormwater before discharging from the Site.

Additional engineering controls implemented by Christenson Oil to enhance SWPPCMs include the 2002 installation of a new OWS and catch basin (CB-1), and repaving of the asphalt surface between the loading dock and NW St. Helens Road. Additionally, a two stage filter was installed in catch basin CB-1 in 2006, which includes a metal debris basket and a vermiculite filter designed to pick up O&G. TSS and pollutants associated with TSS. The SCMs implemented at the Site are described in greater detail below.

6.1 CATCH BASIN AND OIL WATER SEPARATOR INSTALLATION

In 2002, a catch basin CG-1 was installed as a replacement of an existing catch basin; a 6,300 gallon capacity OWS was installed at the Site to intercept stormwater received by catch basin CB-1 prior to discharging into the COP stormwater conveyance system; and, area between the loading dock and NW St. Helens Road was repaved with asphalt. The new catch basin and OWS were selected as SCMs for the Site for the purpose of segregating TSS and emulsified oil from stormwater. The objective of the selected SCMs was to eliminate or reduce the concentrations of pollutants with the potential to negatively impact the receiving waterbody to be discharged in stormwater from the Site. The OWS is cleaned and/or maintained on a semi-annual schedule, generally in the spring and fall. The effectiveness of the SCM is demonstrated by a comparison of pre- and post-installation sampling data, as well as the observed accumulations of materials within the OWS.

6.2 CB-1 TWO-STAGE FILTER

In 2006, a two stage filter was installed in catch basin CB-1 which included a metal debris basket and a vermiculite filter designed to reduce the potential for O&G, TSS or other pollutants associated with TSS from entering the stormwater system. The two-stage filter was selected as an SCM to reduce the volume and concentration of TSS and associated pollutants from entering into the stormwater conveyance system. The catch basin filter is cleaned and/or maintained on a semi-annual basis, generally in the spring and fall. The effectiveness of the SCM is demonstrated by a comparison of pre- and post-installation data, as well as the visible sediment load captured by the filter.

7.0 SOURCE CONTROL EVALUATION

7.1 DATA EVALUATION

An evaluation of stormwater and sediment data collected at the Site over the course of time demonstrates the elimination or significant decline in COI concentrations resulting from the implementation of various effective SCMs, BMPs and preventative measures. Data charts provided as Appendix F visually compare historical and recent stormwater data. The reduction in concentrations of Site COIs and TSS following the installation of the OWS system and the two-stage catch basin filter clearly supports the effectiveness of the SCMs.

Inherent to industrial operations are activities with the potential to result in minor releases of contaminants, despite excellent stormwater management practices. In general, possible releases from industrial facilities include: petroleum products in drips of oils, greases and fuels used for vehicles and machinery; phthalates off-gassing from paints and PVC piping; and zinc resulting from forklift tire dust, hydraulic oil drips and galvanized building surfaces. Offsite sources including highway traffic, operations at neighboring sites and atmospheric deposition may also contribute to the contaminant load in stormwater runoff from the Site. As discussed previously, recent stormwater and sediment data are indicative of typical stormwater discharges associated with light industrial activities. Minor exceedances of a limited number of COCs observed in the SCE data are reflective of the conservative nature of the JSCS SLVs, rather than the inadequacy of stormwater SCMs and BMPs at the Site.

Consistent with the information presented in the *Guidance for Evaluating the Stormwater Pathway at Upland Sites – Appendix E: Tool for Evaluating Stormwater Data* (DEQ, 2010), analytical results suggest that stormwater is not being unusually impacted by contaminants at the Site and is therefore representative of “typical” industrial stormwater for Portland Harbor sites. As stated in DEQ’s guidance document, industrial stormwater is likely to contain a somewhat predictable list of contaminants within a predictable concentration range even when good stormwater management practices are being implemented. Each of the stormwater COI SLV exceedances from the Site are included in the list of predictable contaminants and fall within the predictable concentration range provided by DEQ. No other lines of evidence indicate that discharges from the Site are likely to have an unacceptable impact on the receiving waterbody.

SCMs and preventative measures implemented at the Site, as well as continued good housekeeping, are responsible for the considerable improvement in the quality of stormwater discharges. These measures will continue to be in place at the Site, as is required by the COP BES under the NPDES General Permit.

7.2 OTHER LINES OF EVIDENCE

The following additional lines of evidence were considered in the screening evaluation of SCE data.

> <u>Discharges to 303(d) Listed Waterbodies</u>
>
> The following constituents exceed the Ambient Water Quality Criteria in the Willamette River for river miles 0 through 24.8: aldrin; DDT; DDT metabolite; dieldrin; dioxin (2,3,7,8-TCDD); iron; manganese; mercury; PCBs; pentachlorophenol; and PAHs. Discharges from the Site containing iron, manganese or PAHs at concentrations exceeding their respective SLVs were more conservatively evaluated in order to protect the beneficial

uses of the Willamette River. Concentrations of the aforementioned COCs have decreased significantly over the course of data collection at the Site and, based on DEQ guidance documents for stormwater screening, are well within the range of what are considered “typical” industrial stormwater discharges.

Outfall Sediments

Based on contaminant concentrations in Willamette River sediment samples, Outfall#18 is within a river reach identified by EPA as an area of potential concern for PCBs, copper, lead, zinc, tributyltin, DDT, PAHs and phthalates, and by the LWG for PCBs, aldrin, and DDT. Special consideration was given to the possibility of significant contribution of any of these contaminants from the Site.

Between March 2007 and June 2009, the COP BES conducted an investigation of inline solids in the Outfall Basin #18 stormwater conveyance system to evaluate stormwater discharges representative of the mixed use basin (Basin #18) (COP, 2010). The investigation involved the subdivision of Basin #18 into the following subbasins: western subbasin, west-central subbasin, east-central subbasin and eastern subbasin. The western subbasin receives drainage from Forest Park and several industrial facilities in the vicinity of NW St. Helens Road, including Christenson Oil. Investigation results indicated that sources of PCBs, pesticides and metals are present in Basin #18 discharges, and that pollutant concentrations were significantly higher in two of the four subbasins sampled. Significant findings of the investigation as they pertain to the Site SCE are summarized below:

- PCBs were detected at concentrations exceeding JSCS Bioaccumulation and/or Toxicity SLVs from the west-central and east-central subbasin samples. PCBs were not detected in the western and eastern subbasin samples.
- Samples from the west-cental and east-central subbasins exceeded JSCS Toxicity SLVs for arsenic, cadmium, copper, lead, manganese, nickel and zinc. Samples from the western subbasin did not exceed JSCS Toxicity SLVs for metals. There was insufficient volume to analyze for metals in the eastern subbasin.
- Few individual PAHs were detected in excess of the JSCS SLVs, and detections were within one order-of-magnitude of the SLVs. While a JSCS SLV for total PAH does not exist, total PAH concentrations in all samples collected from the western, west-central and east-central subbasins are considered low. There was insufficient volume to analyze for PAHs in the eastern subbasin.
- The only phthalate detected in any of the samples at somewhat elevated concentrations was BEHP. Although the BEHP concentrations in samples collected from the west-central and east-central subbasins are considered slightly elevated relative to the SLVs, the data as a whole do not indicate the presence of significant uncontrolled BEHP sources within the basin.
- Investigation of the western subbasin concluded that concentrations for all sediment contaminants were low and that no further source tracing is needed for the western subbasin at this time.

The findings of the Outfall #18 inline solids investigation strongly support the conclusions from Site-specific SCE data, which are that Site stormwater discharges are not causing or contributing to adverse impacts to the receiving waterbody, nor are they likely to do so.

Periodicity of Site Activities

Consideration was given to the representativeness of catch basin sediment samples based on the potential for variability of Site activities. Catch basin CB-1 is cleaned/ maintained on a semiannual basis, generally in the spring and fall. Timing of the catch basin sediment sampling was coordinated with Site personnel to ensure that sufficient and representative catch basin sediment had accumulated. Site operations are consistent and primarily include the loading and unloading of bulk lubricant products. Site operations occurring in the vicinity of catch basin CB-1 are primarily bulk truck and fork lift traffic near the receiving dock and the lubricant dispensing area.

Future Stormwater Management

Ongoing oversight of stormwater management practices currently being implemented at the Site will continue through the issuance of the NPDES General Permit.

8.0 FINDINGS AND CONCLUSIONS

1. Existing and potential facility-related contaminant sources have been identified and characterized.

- The source area at the Site includes that portion of the impervious surface of the Facility which flows toward and into catch basin CB-1. Potential sources of contamination include those associated with routine, light industrial activities. Specifically, these include:
  - Minor drips of oils, greases and fuels from bulk trucks and machinery. COIs include: TPH as GRO, DRO and ORO; PAHs; phthalates; and, metals.
  - Forklift and vehicle traffic resulting in tire dust and gradual erosion of asphalt surfaces. COIs include: metals; TPH as GRO, DRO and ORO; PAHs and, phthalates.
  - Stormwater runoff from the Main Building's galvanized roof. COIs include: metals.
  - Atmospheric deposition of pollen and dust. COIs include: metals.
- Lines of evidence used to determine that all sources have been identified and characterized include the following:
  - Stormwater and sediment sampling was conducted in accordance with the applicable regulatory guidance documents. The sample results are considered to be representative of stormwater discharges from the Site.
  - The increased concentrations of heavy metals in stormwater sample SW-OWS-EF-052112 appear to be associated with the presence of pollen in the sample.
  - Inspection of the Site's storm sewer conveyance system indicates that it is in good-working condition and shows no signs of disrepair. The inspection, in conjunction with the elevation survey of stormwater components, confirms the incomplete pathway between groundwater and the stormwater system.
  - Use of the regulatory screening tool provided by DEQ for the evaluation of stormwater data confirms that COC concentrations in stormwater are minor and do not implicate the need for additional SCMs. The consideration of additional lines of evidence further supports this conclusion.

2. Contaminant sources are being controlled to the extent feasible.

- Existing or potential sources at the Site are being controlled through the use of BMPs, preventative measures and the interception of contaminants through SCMs such as the two-stage filter in catch basin CB-1, the OWS system, and the secondary containment in tank farm areas.
- SCM and stormwater BMP effectiveness has been assessed through the evaluation of stormwater and sediment data collected at the Site over time. With the exception of zinc, each Site COI has seen a significant reduction in concentration or was eliminated entirely. Analytical data provide the basis for this evaluation.
- Contaminants that continue to exceed SLVs in stormwater following the implementation of SCMs include:

- Benzo(a)anthracene;
- Chrysene;
- Benzo(b)fluoranthene;
- Benzo(a)pyrene;
- Indeno(1,2,3-cd)pyrene
- Arsenic;
- Cadmium;
- Copper;
- Lead;
- Manganese;
- Nickel; and
- Zinc.

- Contaminants that continue to exceed SLVs in sediment following the implementation of SCMs include:
  - BEHP;
  - Indeno(1,2,3-cd)pyrene;
  - Benzo(g,h,i)perylene;
  - Cadmium;
  - Lead; and
  - Zinc.
- Sources of the COIs listed above include those associated with routine, light industrial activities. Specifically, these include:
  - Minor drips of oils, greases and fuels from bulk trucks and machinery;
  - Forklift and vehicle traffic resulting in tire dust and gradual erosion of asphalt surfaces;
  - Stormwater runoff from the Main Building's galvanized metal roof; and,
  - Atmospheric deposition of dust and pollen.
- The relatively minor exceedances of Site COCs as compared to other Portland Harbor industrial sites demonstrate that stormwater BMPs are strictly adhered to during Site operations. SCMs implemented at the Site address all potential sources of stormwater contaminates upon discharge to catch basin CB-1, and have proven to be effective through the reduction of COC concentrations in stormwater samples. Because stormwater runoff from the source area is currently treated by multiple SCMs, it appears unlikely that the implementation of additional SCMs would achieve better results. It can be concluded then that Site operations would need to disproportionately limit or stop entirely in order for there to be a substantial reduction or total elimination of COC detections in stormwater.

3. **If pre- and post-SCM data was collected, post-SCM data supports the conclusion that the SCM is effective.**

   - A comparison of stormwater analytical results for pre- and post-SCM sampling identifies a decrease in frequency of COCs detected at or above the SLVs. Data charts provided as Appendix F visually compare historical and recent stormwater data. The reduction in concentrations of Site COCs and TSS following the installation of the OWS system and the two-stage catch basin filter clearly supports the effectiveness of the SCMs. Sampling data collected prior to the initiation of the SCE are provided in Tables 1, 3, 7 and 8.

4. **Adequate measures are in place to ensure source control and good stormwater management measures occur in the future.**

   - On-going stormwater management measures, including employee education and training; debris removal; exposure reduction; and runoff diversion are in place at the Site to minimize risk of COCs migrating into the stormwater conveyance system. BMP and SCM effectiveness will continue to be evaluated by the COP BES and DEQ in accordance with the NPDES General Permit for the Site.

5. **Contaminants in stormwater that continue to exceed SLVs in spite of SCMs and stormwater management measures are not likely to result in sediment contamination in the receiving waterbody or contribute to unacceptable risk.**

   - The following findings and evaluation of the stormwater discharged from the Site determine that contaminants in stormwater are not likely to result in the contribution to unacceptable risk or sediment contamination in the Willamette River.

     - Consistent with the information presented in the *Guidance for Evaluating the Stormwater Pathway at Upland Sites – Appendix E: Tool for Evaluating Stormwater Data* (DEQ, 2010), analytical results suggest stormwater is not being unusually impacted by contaminants at the Site, and is representative of "typical" industrial stormwater for Portland Harbor sites. As stated in DEQ's guidance document, industrial stormwater is likely to contain a somewhat predictable list of contaminants within a predictable concentration range even when good stormwater management practices are being implemented. Each of the stormwater COC SLV exceedances from the Site are included in the list of predictable contaminants and fall within the predictable concentration range provided by DEQ.

     - The findings of the COP BES Outfall #18 inline solids investigation (COP BES, 2010) are consistent with the Site-specific SCE data, which support a conclusion that the Site stormwater discharges are not causing or contributing to adverse impacts to the receiving waterbody, nor are they likely to do so.

     - TSS was detected at 14 mg/l during the first stormwater sampling event, and was not detected above the laboratory MDL during the three subsequent sampling events.

     - The total area from which stormwater runoff can be discharged from the Site to the stormwater conveyance system is approximately 12,660 square-feet.

9.0 REFERENCES

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FIGURES

SOURCE CONTROL EVALUATION REPORT
CHRISTENSON OIL COMPANY
PORTLAND, OREGON

PACIFIC CREST NO. 123-001
ECSI NO. 2426

TABLES

SOURCE CONTROL EVALUATION REPORT
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APPENDIX A
HERITAGE SURVEY MAP

SOURCE CONTROL EVALUATION REPORT
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APPENDIX B
STORM SEWER CONVEYANCE SYSTEM VIDEO

SOURCE CONTROL EVALUATION REPORT
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APPENDIX C
TANK FARM SUMMARY

SOURCE CONTROL EVALUATION REPORT
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APPENDIX D
OUTFALL #18 SEDIMENT SAMPLE LOCATIONS

SOURCE CONTROL EVALUATION REPORT
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APPENDIX E
LABORATORY ANALYTICAL REPORTS

SOURCE CONTROL EVALUATION REPORT
CHRISTENSON OIL COMPANY
PORTLAND, OREGON

PACIFIC CREST NO. 123-001
ECSI NO. 2426

APPENDIX F
SAMPLING DATA CHARTS

SOURCE CONTROL EVALUATION REPORT
CHRISTENSON OIL COMPANY
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